IN THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claim 1 (Currently Amended): A magnetic head provided with a spin-valve type magnetoresistive element in which a ferromagnetic layer a direction of the magnetization of which is substantially pinned for an external magnetic field and a soft magnetic free layer the magnetization of which can be turned according to an external magnetic field, are laminated, via a non-magnetic intermediate layer, and characterized in that the magnetization of the soft magnetic free layer is rotated according to the external magnetic field, a relative angle between a direction of the magnetization of the soft magnetic layer and a direction of the magnetization of the ferromagnetic layer varies and magnetoresistance is produced, wherein:

a single magnetic domain turning ferromagnetic layer is formed on the soft magnetic free layer, via a non-magnetic separating layer;

the single magnetic domain turning ferromagnetic layer turns the soft magnetic free layer a single magnetic domain so that the soft magnetic free layer has magnetization substantially induced in a direction substantially perpendicular to an external magnetic field because the soft magnetic free layer and the single magnetic domain turning ferromagnetic layer are magnetostatically coupled, via the non-magnetic separating layer, at the end of track width, and a closed magnetic circuit is formed; ~~and~~

the single magnetic domain turning ferromagnetic layer has effectively fixed magnetization in the direction of substantially perpendicular to an external magnetic field from a magnetic medium; and

the single magnetic domain turning ferromagnetic layer is provided with a hard magnetic film made of a mixture of a semiconductor and ferromagnetic metal.

Claim 2 (Currently Amended): A magnetic head, comprising:

a spin-valve type magnetoresistive element in which a ferromagnetic pinned layer, a non-magnetic intermediate layer, a soft magnetic free layer, a non-magnetic separating layer and a single magnetic domain turning ferromagnetic layer are laminated in the order and are formed in substantially the same track width corresponding to a predetermined magnetic field sensing width, wherein:

no ferromagnetic or antiferromagnetic coupling is substantially produced between the soft magnetic free layer and the single magnetic domain turning ferromagnetic layer, via the non-magnetic separating layer, the magnetization of the single magnetic domain turning ferromagnetic layer and the magnetization of the soft magnetic free layer are magnetostatically coupled at the end of track width, and a closed magnetic circuit is formed;

the soft magnetic free layer is turned a single magnetic domain so that the soft magnetic free layer has magnetization substantially induced in a direction substantially perpendicular to an external magnetic field;

a direction of the magnetization of the ferromagnetic induced layer is substantially pinned for an external magnetic field, the magnetization of the soft magnetic free layer is turned according to an external magnetic field, a relative angle

between the magnetization of the soft magnetic free layer and the magnetization of the ferromagnetic pinned layer varies, magnetoresistive change is generated in the magnetoresistive element and is detected by a pair of electrodes; ~~and~~

the single magnetic domain turning ferromagnetic layer has effectively fixed magnetization in the direction of substantially perpendicular to an external magnetic field from a magnetic medium; and

the single magnetic domain turning ferromagnetic layer is provided with a hard magnetic film made of a mixture of a semiconductor and ferromagnetic metal.

Claim 3 (Original): A magnetic head according to Claim 1, wherein:

a bias magnetic field is applied to the ferromagnetic pinned layer by laminating the ferromagnetic pinned layer and an antiferromagnetic film or a hard magnetic film and producing exchange coupling and the ferromagnetic pinned layer is polarized in a direction substantially perpendicular to an external magnetic field.

Claim 4 (Original): A magnetic head according to Claim 1, wherein:

the single magnetic domain turning ferromagnetic layer is formed by a hard magnetic film; and

the hard magnetic film is magnetizing in a direction substantially perpendicular to an external magnetic field.

Claim 5 (Original): A magnetic head according to Claim 1, wherein:

the single magnetic domain turning ferromagnetic layer is formed by a layered film having ferromagnetic or antiferromagnetic coupling between a hard magnetic film and a soft magnetic buffer layer, via a coupling film; and

the magnetization of the hard magnetic film and the magnetization of the soft magnetic buffer layer are polarized in a direction substantially perpendicular to an external magnetic field.

Claims 6-8 (Canceled):

Claim 9 (Original): A magnetic head according to Claim 1, wherein:

the non-magnetic separating layer is made of Ta, Hf, Nb, Ti or W or the oxide of any of these.

Claim 10 (Original): A magnetic head according to Claim 1, wherein:

the non-magnetic separating layer is formed by a deposition of a layer including at least one of Cu, Au, Ag, Pt, Re, Ru, Ir, Os, Ta, Hf, Nb, Ti and W or a layer including these and a layer made of oxide or a mixture of at least one of Cu, Au, Ag, Pt, Re, Ru, Ir, Os, Ta, Hf, Nb, Ti and W and oxide.

Claim 11 (Previously Presented): A magnetic head according to Claim 2, wherein:

the single magnetic domain turning ferromagnetic layer is formed by a hard magnetic film; and

the hard magnetic film is magnetizing in a direction substantially perpendicular to an external magnetic field.

Claim 12 (Previously Presented): A magnetic head according to Claim 2, wherein:

the single magnetic domain turning ferromagnetic layer is formed by a layered film having ferromagnetic or antiferromagnetic coupling between a hard magnetic film and a soft magnetic buffer layer, via a coupling film; and

the magnetization of the hard magnetic film and the magnetization of the soft magnetic buffer layer are polarized in a direction substantially perpendicular to an external magnetic field.

Claims 13-15 (Canceled):

Claim 16 (Currently Amended): A magnetic head comprising:

a magnetoresistive element having a soft magnetic free layer, a ferromagnetic pinned layer and a non-magnetic layer formed between the soft magnetic free layer and the ferromagnetic pinned layer,

a single magnetic domain turning ferromagnetic layer having effectively fixed magnetization in the direction of substantially perpendicular to an external magnetic field from a magnetic medium, formed above the soft magnetic free layer,

wherein a magnetization of the single magnetic domain turning ferromagnetic layer and a magnetization of the magnetic free layer are magnetostatically coupled at the end of track width, and

wherein the single magnetic domain turning ferromagnetic layer is provided with a hard magnetic film made of a mixture of a semiconductor and ferromagnetic metal.

Claim 17 (Previously Presented): A magnetic head according to claim 16, wherein the total magnetization of the single magnetic domain turning ferromagnetic layer and the magnetic free layer forms a closed magnetic circuit.

Claim 18 (Previously Presented): A magnetic head according to claim 16, wherein a non-magnetic separating layer is formed between the single, magnetic domain turning ferromagnetic layer and the soft magnetic free layer.

Claim 19 (Previously Presented): A magnetic head according to claim 16, wherein the single magnetic domain turning ferromagnetic layer turns the soft magnetic free layer a single magnetic domain so that the soft magnetic free layer has magnetization substantially induced in a direction substantially perpendicular to an external magnetic field.

Claim 20 (Previously Presented): A magnetic head according to Claim 16, wherein:

a bias magnetic field is applied to the ferromagnetic pinned layer by laminating the ferromagnetic pinned layer and an antiferromagnetic film or a hard magnetic film and producing exchange coupling and the ferromagnetic pinned layer is polarized in a direction substantially perpendicular to an external magnetic field.

Claim 21 (Previously Presented): A magnetic head according to Claim 16, wherein:

the single magnetic domain turning ferromagnetic layer is formed by a hard magnetic film; and

the hard magnetic film is magnetizing in a direction substantially perpendicular to an external magnetic field.

Claim 22 (Previously Presented): A magnetic head according to Claim 17, wherein:

the single magnetic domain turning ferromagnetic layer is formed by a layered film having ferromagnetic or antiferromagnetic coupling between a hard magnetic film and a soft magnetic buffer layer, via a coupling film; and

the magnetization of the hard magnetic film and the magnetization of the soft magnetic buffer layer are polarized in a direction substantially perpendicular to an external magnetic field.

Claims 23-25 (Canceled):

Claim 26 (Previously Presented): A magnetic head according to Claim 16, wherein:

the non-magnetic separating layer is made of Ta, Hf, Nb, Ti or W or the oxide of any of these.

Claim 27 (Previously Presented): A magnetic head according to Claim 16, wherein:

the non-magnetic separating layer is formed by a deposition of a layer including at least one of Cu, Au, Ag, Pt, Re, Ru, Ir, Os, Ta, Hf, Nb, Ti and W or a layer including these and a layer made of oxide or a mixture of at least one of Cu, Au, Ag, Pt, Re, Ru, Ir, Os, Ta, Hf, Nb, Ti and W and oxide.

Claim 28 (New): A magnetic head provided with a spin-valve type magnetoresistive element in which a ferromagnetic layer a direction of the magnetization of which is substantially pinned for an external magnetic field and a soft magnetic layer the magnetization of which can be turned according to an external magnetic field are laminated via a non-magnetic intermediate layer and characterized in that the magnetization of the soft magnetic layer is rotated according to the external magnetic field is induced, a relative angle between a direction of the magnetization of the soft magnetic layer and a direction of the magnetization of the ferromagnetic layer varies and magnetoresistance is produced, wherein:

a single magnetic domain turning ferromagnetic layer is formed on the soft magnetic free layer via a non-magnetic separating layer;

the single magnetic domain turning ferromagnetic layer turns the soft magnetic free layer a single magnetic domain so that the soft magnetic free layer has magnetization substantially induced in a direction substantially perpendicular to an external magnetic field because the soft magnetic free layer and the single magnetic domain turning ferromagnetic layer are magnetostatically coupled, via the

non-magnetic separating layer, at the end of track width and a closed magnetic circuit is formed;

the single magnetic domain turning ferromagnetic layer is formed by a layered film having ferromagnetic or antiferromagnetic coupling between a hard magnetic film and a soft buffer layer, via a coupling film; and

the magnetization of the hard magnetic film and the magnetization of the soft magnetic buffer layer are polarized in a direction substantially perpendicular to an external magnetic field.

Claim 29 (New): A magnetic head according to Claim 28, wherein:

the single magnetic domain turning ferromagnetic layer is provided with a hard magnetic film made of oxide including Fe, Co, Ni or Mn.

Claim 30 (New): A magnetic head according to Claim 28, wherein:

the single magnetic domain turning ferromagnetic layer is provided with a hard magnetic film made of a mixture of oxide and ferromagnetic metal.

Claim 31 (New): A magnetic head, comprising:

a spin-valve type magnetoresistive element in which a ferromagnetic pinned layer, a non-magnetic intermediate layer, a soft magnetic free layer, a non-magnetic separating layer and a single magnetic domain turning ferromagnetic layer are laminated in the order and are formed in substantially the same track width corresponding to predetermined magnetic field sensing width, wherein:

no ferromagnetic or antiferromagnetic coupling is substantially produced between the soft magnetic free layer and the single magnetic domain turning ferromagnetic layer via the non-magnetic separating layer, the magnetization of the single magnetic domain turning ferromagnetic layer and the magnetization of the soft magnetic free layer are magnetostatically coupled at the end of track width and a closed magnetic circuit is formed;

the soft magnetic free layer is turned a single magnetic domain so that it has magnetization substantially induced in a direction substantially perpendicular to an external magnetic field;

a direction of the magnetization of the ferromagnetic induced layer is substantially pinned for an external magnetic field, the magnetization of the soft magnetic free layer is turned according to an external magnetic field, a relative angle between the magnetization of the soft magnetic free layer and the magnetization of the ferromagnetic pinned layer varies, magnetoresistive change is generated in the magnetoresistive element and is detected by a pair of electrodes;

the single magnetic domain turning ferromagnetic layer is formed by a layered film having ferromagnetic or antiferromagnetic coupling between a hard magnetic film and a soft magnetic buffer layer, via a coupling film; and

the magnetization of the hard magnetic film and the magnetization of the soft magnetic buffer layer are polarized in a direction substantially perpendicular to an external magnetic field.

Claim 32 (New): A magnetic head according to Claim 31, wherein:

the single magnetic domain turning ferromagnetic layer is provided with a hard magnetic film made of oxide including Fe, Co, Ni or Mn.

Claim 33 (New): A magnetic head according to Claim 31, wherein:

the single magnetic domain turning ferromagnetic layer is provided with a hard magnetic film made of a mixture of oxide and ferromagnetic metal.

Claim 34 (New): A magnetic head comprising:

a magnetoresistive element having a soft magnetic free layer, a ferromagnetic pinned layer and a non-magnetic layer formed between the soft magnetic free layer and the ferromagnetic pinned layer,

a single magnetic domain turning ferromagnetic layer having effectively fixed magnetization in the direction of substantially perpendicular to an external magnetic field from a magnetic medium, formed above the soft magnetic free layer, wherein:

a magnetization of the single magnetic domain turning ferromagnetic layer and a magnetization of the magnetic free layer are magnetostatically coupled at the end of track width,

the single magnetic domain turning ferromagnetic layer is formed by a layered film having ferromagnetic or antiferromagnetic coupling between a hard magnetic film and a soft magnetic buffer layer, via a coupling film; and

the magnetization of the hard magnetic film and the magnetization of the magnetization of the soft magnetic buffer layer are polarized in a direction substantially perpendicular to an external magnetic field.

Claim 35 (New): A magnetic head according to Claim 34, wherein:

the single magnetic domain turning ferromagnetic layer is provided with a hard magnetic film made of oxide including Fe, Co, Ni or Mn.

Claim 36 (New): A magnetic head according to Claim 34, wherein:

the single magnetic domain turning ferromagnetic layer is provided with a hard magnetic film made of a mixture of oxide and ferromagnetic metal.

Claim 37 (New): A magnetic head comprising:

a magnetoresistive element having a soft magnetic free layer, a ferromagnetic pinned layer and a non-magnetic layer formed between the soft magnetic free layer and the ferromagnetic pinned layer,

a single magnetic domain turning ferromagnetic layer having effectively fixed magnetization in the direction of substantially perpendicular to an external magnetic field from medium, formed above the soft magnetic free layer,

wherein a magnetization of the single magnetic domain turning ferromagnetic layer and a magnetization of the magnetic free layer are magnetostatically coupled at the end of track width,

wherein a single magnetic domain turning ferromagnetic layer is having a hard magnetic film, a soft magnetic film and a coupling film formed between the hard magnetic film and the soft magnetic film.

Claim 38 (New): A magnetic head according to claim 37, wherein the soft magnetic film is ferromagnetically coupled to the hard magnetic film, via the coupling film.

Claim 39 (New): A magnetic head according to claim 38, wherein the coupling film comprises Ta or alumina.

Claim 40 (New): A magnetic head according to claim 37, wherein the soft magnetic film is antiferromagnetically coupled to the hard magnetic film, via the coupling film.

Claim 41 (New): A magnetic head according to claim 40, wherein the coupling film comprises Ru or Ir.